

with special reference to its use for the clothing and personal effects of officers and men on board ship. The results were favorable, and brief mention of them was included in a report made to the Surgeon-General of the Navy. This agent has recently been the subject of examination by officers of the Marine-Hospital Service, of the Bureau of Animal Industry, and of several of the State boards of health. Some brief papers were read before the association, and Dr. Kinyoun gave an abstract of an extended paper on its use for sleeping car, baggage, and quarantine disinfection.

The destructive action of formic aldehyde on disease germs has been fully proven. Professor Robinson, of Bowdoin College, claimed to have disinfected a room of 3,000 cubic feet in one hour's time by the formic aldehyde generated by a special lamp of his own device from 1 liter of methyl alcohol. Cultures of bacteria were killed under bed-clothing, in a mattress, and under one-half inch of sand. The amount of formic aldehyde must have been much less than 1 per cent. Dr. Kinyoun stated that air saturated with formic aldehyde killed germs in from one and one-half to two minutes. Exposure to $1\frac{1}{4}$ per cent of the gas for twenty-four hours resulted in the death of germs protected by 12 layers of blankets or 30 to 40 layers of cotton sheeting. The bacilli most easily killed were those of diphtheria, and the next weakest were tubercle bacilli. In the proportion of 1-10,000 formic aldehyde is an efficient deodorizer.

Formic aldehyde can be readily and economically applied. If generated by an inexpensive lamp the cost is that of the wood alcohol consumed. In 40 per cent solutions it is commercially sold under various names at from 50 cents to \$1.50 per pound.

It does not injure fabrics. In my experiments gold lace, gilt buttons, sword belts, caps, book bindings of fugitive colors, and many other more or less suspicious articles, were exposed to its vapors for forty-eight hours without injurious results. I found that polished steel was slightly acted on, but polished brass was not affected. Book-bindings of red, green, and blue cloth, some of them in new and bright colors and others faded, were not changed. Dr. Kinyoun has made a very thorough examination of its action on ribbons, silks, dyed plumes, cotton and woolen goods, leather, etc. He found only two colors that were acted upon. One was Congo red, the other an undetermined aniline dye. He also noticed its action on polished steel. This effect is probably due to a small amount of formic acid, generated with the formic aldehyde, and which is also volatile.

One objection to formic aldehyde as a disinfectant is that it does not readily penetrate thick articles, like blankets and mattresses, unless a partial vacuum has been produced. This objection, however, applies with equal force to other disinfectants now in general use. Another objection arises from the irritant effects of the vapor upon mucous membranes and to some extent upon the skin. Nearly every one who freely handles formic aldehyde becomes painfully conscious of its irritant effect upon the eyes and nasal mucous membranes, and unless mattresses, underclothing, etc., are thoroughly aired after its use, any remaining formic aldehyde is likely to volatilize from the heat of the body and cause irritation. Ammonia unites with and neutralizes formic aldehyde; its vapor is equally penetrating and will remove any disagreeable effects. Attendants should be careful to avoid the fumes of formic aldehyde as much as possible during and after its use. The fumes are disagreeable and irritating, but not poisonous or dangerous.

Formic aldehyde is best used in as dry a form as practicable. With

steam or water it is not so efficient as in vapor, although dilute solutions are valuable for surface disinfection.

Several forms of special lamp for the generation of formic aldehyde have been devised and three were shown at the association. No statements were made giving the percentage of yield in actual use, and, although satisfactory results were shown, further information in this direction is desirable.

The solutions in commerce are practically 40 per cent formic aldehyde in water or methyl alcohol. These may be readily used in the following manner: In a compartment which can be closed, pile the clothing, etc., loosely, with alternate layers of towels, sheets, etc., which have been well-dampened with the solution, then cover all closely with a tarpaulin and leave undisturbed for twenty-four or forty-eight hours.

I have given considerable space to this subject in my report, as, in my opinion, the use of this disinfectant will remove the objections which naval officers make to the exposure of their uniforms and other personal effects to ordinary methods of disinfection.

Several papers on public health in the Republic of Mexico were read before the association; also papers or reports on "Nomenclature of diseases and forms of statistics," "The transportation and disposal of the dead," "The prevention of blindness," "On isolation hospitals," "National health legislation," "Sanitary administration," "Public baths," "Alcoholic drinks," "The bicycle and its sanitary aspects," and on yellow, typhus, typhoid, and malarial fevers, dengue, and diphtheria as related to public health. Serum diagnosis included a very important paper by Dr. Wyatt Johnson, of Canada, on the diagnosis of typhoid fever.

The method as advocated by him is now being put to practical use in Quebec, where the board of health will make the necessary examinations for the medical profession, free of charge. (Public Health Reports, October 23, 1896, p. 995.)

The executive work of the association included favorable action on several resolutions connected with papers and discussions and the appointment of some new committees on important subjects. None of them had any special relation to the Navy or naval hygiene.

Philadelphia was selected as the next place of meeting and Dr. Henry D. Horlbeck, of Charleston, S. C., was elected president for the coming year.

HANDLING AND CARE OF WOUNDED IN MODERN NAVAL WARFARE.¹

By WILLIAM K. VAN REYPEN, *Medical Director, United States Navy.*

How best to handle and care for wounded in modern naval warfare is a problem that now confronts naval surgeons. It is thrust upon us by the energy and accomplishments of experts in construction, ordnance, and engineering. While they have so successfully fulfilled their mission of destruction, we must not be laggards in our still more important work of succor to the wounded and helpless. It is theirs to destroy. It is ours to save.

The conditions under which we find ourselves in the present day of battle ships necessitate a radical departure from our former methods

¹Read before the Twelfth International Medical Congress, held at Moscow, Russia, August 19-26, 1897.

of treatment of wounded men in action, and their subsequent care. In the days of wooden ships, with flush gun and spar decks, admitting of comparatively easy transportation of wounded, there was very little difficulty in moving men injured in action to the sick bay, where they could receive every needed surgical attention. The surgical staff was a unit, exercising its function in a circumscribed sphere. Its work was brought before it; now it must seek it.

A modern battle ship is a honeycomb of steel, each cell containing its quota of workers, all acting harmoniously and in concert toward the accomplishment of the desired end, the overthrow of the adversary. Separated from their fellows by steel decks and water-tight doors, some means for their assistance in time of distress must be devised by naval surgeons; means that will not interfere with the fighting efficiency of the whole, and yet sufficient to assure the combatants that if disabled in the performance of their duty they will not be cast aside as useless incumbrances.

Anyone familiar with the construction of a modern battle ship will readily see the impossibility of caring for wounded men as in the days of wooden ships. The object of making closed compartments is to have them closed in time of action. The object of battle plates is to have them screwed on in time of battle. By as much as these precautions are neglected, by so much is the efficiency of the fighting machine decreased. In the tops, in the superstructure, and in some of the living spaces men may be reached and cared for, but never again in modern warfare will the sick bay be the place where all the wounded will be brought during an action, and where the surgical staff will expend all of their energies.

It is more than probable that future sea fights will be short and bloody, and be fought at short range. With modern rapid-fire guns, all exposed parts of a vessel would soon be cleared of the living occupants and heavy armor would be the only protection. The personal danger confronting the surgeon will be greater than ever before. It will be his object to do the greater good to the greatest number. Except in limited numbers his patients can not be brought to him; he must go to them. He will scarcely ever be able to perform a capital operation during an action; time will not permit. He must be here, there, and everywhere. If he can find a sheltered place anywhere in the ship where he will not be in the way of a gun, a torpedo tube, a trolley, or an ammunition hoist, let him there establish a central station and a line of communication with all accessible parts of the ship. No particular part of the ship can be here designated as this central station; it must vary in accordance with the construction of the vessel. It should be the place where there would be the greatest protection, with the greatest accessibility. In case of a lull in, or immediately after, an action, the wounded should be taken there and such operations as are practicable performed. In vessels where there is not free communication fore and aft, there should be two such stations with at least one surgeon assigned to each. During an action many men will fall in places where, if two or more of their comrades were detailed as carriers, it would disable the fighting force of the gun and give the enemy a greater chance of victory. We must reconcile ourselves to the fact that the primary object of combat is to vanquish your adversary, and must accommodate ourselves to the situation.

Some means of communication, vocal or electrical, should be established between each compartment or fighting space and the central station, so that the surgeon can be informed where his services are

required, if the wounded can not be speedily removed. Meanwhile the importance of first aid is clearly manifest. This first aid can only be rendered by comrades. The thorough instruction of the whole ship's company in the efficient manner of thus administering first aid can not be too strongly urged. One of the first duties of the surgical staff of a newly commissioned vessel should be the drilling of the crew in the proper methods of controlling hæmorrhage from different parts of the body, the removal of foreign bodies from wounds, and the placing in proper positions of injured or broken limbs. They should also be taught how to carry a man up or down through narrow hatches, over obstacles, or through contracted or tortuous passages with the least fatigue to themselves and the greatest comfort to the wounded. In many instances it would be impossible to use a cot or any form of stretcher; under these circumstances the only alternative is that the disabled should be carried.

The fighting space allotted, especially in turrets, is so contracted that the immediate removal of a disabled or wounded man is of the utmost importance. There is no unoccupied space in the turret where he could be laid aside, out of the way of the gun workers, until action is over. His presence would temporarily disable the gun. The only practicable method of caring for him is to lower him to the partially cleared space at the base of the turret, either by the ammunition hoist or lashed in a hammock; even here he would only receive temporary aid, as the space is too limited for the performance of any operation. Here he must remain until a favorable opportunity arises for his transfer to the central station.

The equipment of the surgeon and his assistants must be the simplest, and yet the most effective. They will have very little immediate use for anything but brandy, ammonia, morphia, and the requirements for the control of hæmorrhage. With these they can quickly leave the central station for any part of the ship where their services may be required, and superintend the bringing back of the patient.

The simplest method of transportation, and the one causing the least discomfort to the wounded, is a stretcher on which a mattress and pillow have been laid, but there are very few places on a battle ship where a stretcher could be conveniently used. It is inapplicable for narrow or tortuous passages for going up or down ladders, or for getting in or out of small compartments. Where the man is so severely injured that he can not be picked up and carried, or where a stretcher can not be used, the device that is considered best in the United States Navy is to lash and carry him, on the same deck, in a hammock containing a mattress; or for transference from one deck to another by means of the apparatus suggested by Passed Assistant Surgeon Stitt. This apparatus consists of "a bar made of 1-inch iron piping, 7 feet long, with ends forged flat and holes drilled in them; snap hooks are attached to these ends; a binding strap moving freely on the pipes gives the point of support, and is capable of being tightened by a thumbscrew. The object of this is to enable one to raise or lower a wounded person at any degree of obliquity. When the men transferring the hammock reach the hatchway, where one of these stretcher bars is rigged, they snap the hooks into the hammock rings and lower away. The advantages of this method are as follows: Ease and freedom from pain, and improbability of injury during movement along deck; rapidity of passages from one deck to another; any hatchway, however small, can be used; a wounded man reaches sick quarters with his hammock; the simplicity of apparatus, which can be made

in a short time on any ship; only two men are required to manipulate and lower it."

The simplicity of this apparatus, as thus described by its inventor, is only equaled by its efficacy in practice. It has now been long enough in use in the United States Navy to place it beyond the stage of experiment and to demonstrate its efficiency.

On the vessels that remain afloat after a modern naval engagement, the decks will be much encumbered with wounded, such first aid as was possible will have been given to them, but their comfort and well-being will by no means be enhanced by retaining them on board the vessel. Naval engagements will not be likely to take place under the lee of a shore hospital, and humanity demands that wounded men shall have speedy transfer to the place where they can be best cared for, and that place can be none other than an ambulance ship. Such a vessel should be as much a component part of a fleet as the admiral's flagship. It would greatly add to the morale of the men behind the guns, when they went into action, if they saw near at hand a commodious hospital, with all the appliances for their care and comfort, and under the superintendence of skilled medical officers. This vessel should be solely and entirely an ambulance ship, with a crew only sufficient to work the ship, and all her available deck room given up to quarters for sick and wounded.

I submit herewith plans of an ambulance ship which has been arranged to include as many conveniences as is practicable in such a vessel. It is primarily a vessel adapted for the care and welfare of sick and wounded men, and all other considerations are made subservient to this end. The vessel as designed will be 3,550 tons displacement; 275 feet on the load line, and 300 feet over all; with twin screws and a speed of 14 knots; 50 feet beam, and drawing 18 feet; a coal capacity of 450 tons, giving eighteen days' steaming at 10 knots. The water tanks will hold 9,000 gallons. The ship will carry 4 steam launches and 4 barges, each barge arranged with a flying floor between the thwarts, so as to conveniently carry 12 cots on the floor. There will be beds for 274, and hammock space for 36. Staterooms for 8 disabled officers, and cot space for 12. The beds for the men are hair mattresses on woven-wire springs, supported by a plain iron framework with corner stanchions. The height of the deck beams being 8 feet, allows 2 tiers of berths. The forward ward on the upper deck has been left with only one tier of berths, for a ward of isolation, or to accommodate more serious cases. The vessel can comfortably accommodate 330 sick or wounded men, with sufficient berthing space for the crew of the vessel. There are quarters for 4 medical officers, 2 apothecaries, and 12 nurses. On the upper deck is an inclosed room, 22 by 24 feet, for convalescent officers, and a room 26 by 35 for convalescent men. On this deck also are the galley, laundry, wash room, drying room, lamp room, closets and bathroom for both officers and men, the office of the senior medical officer and of the executive officer. Dumb-waiters go from the galley to the diet kitchens on the decks below. The upper part of the operating room is also inclosed on this deck.

Near the center of the ship, on the berth deck, is the operating room, 18 by 21 feet. It is well lighted by a large skylight and by air ports above the upper deck. On either side of this operating room is an elevator large enough to hold a cot. The elevator runs from the upper to the lower deck, and is run by electricity. A patient can be hoisted in his cot from the barge alongside the ship, placed in the

elevator, lowered to the operating room, and from there transferred either to a bed on the berth deck or lowered and transferred on the deck below. This transfer is accomplished by means of an overhead trolley, which runs from the operating room and the elevator, between the rows of beds, and by means of which the occupant of any bed can be transferred.

On the engine-room deck is an ice machine and cold storage rooms, a disinfecting chamber, Sturtevant blowers, and ample storerooms for all departments of the ship. The ventilation is accomplished by 2 powerful blowers, with their necessary connections, and supplementary electric fans. The vessel is to be heated by steam and lighted by electricity. The constructor has so arranged the model of the hull as to insure the minimum of motion, either in a head or beam sea. There are steam winches on the upper deck for hoisting or lowering wounded or boats. They can be worked on both sides simultaneously.

The outfit of the operating room will include two or three operating tables of the model approved by the Surgeon-General of the Navy. These tables are of antiseptic value; are light and portable, being easily folded and carried to any part of the ship. The floor of the operating room will be tiled, and all of its appointments arranged with a view to strict antiseptis.

As soon as the action is over, a launch should tow its barge alongside a vessel that has been in action, the wounded should be hoisted out and into the barge by means of the apparatus already described. It should then steam with all dispatch to the ambulance ship, unload its human freight, and speed away again on its mission of humanity. In no other way could wounded men be better cared for, or a fighting vessel be more speedily disencumbered and placed again in readiness for battle.

The ambulance ship would of course fly the Geneva Cross flag. As an angel of mercy she would spread her wings alike over friend and foe, mitigating the horrors of war, and hastening the advent of the day that will bring "peace on earth and good will toward men."

REPORT ON THE SECOND PAN-AMERICAN MEDICAL CONGRESS.

By GEORGE W. WOODS, *Medical Director, United States Navy.*

In obedience to orders of October 15, 1896, I proceeded to the City of Mexico on November 7, 1896, and reported to the president of the second Pan-American Medical Congress, Dr. M. Carmona y Vallé. My duties were completed on the 30th of that month, when I returned to Mare Island, and reported my resumption of duty in charge of the United States naval hospital on the 7th of December.

Over 400 members and delegates were in attendance at the congress, embracing representatives from the United States of North America, Canada, the West India Islands, and the Republics of Central and South America, who crowded the hotels of the capital city, and formed a distinct feature in its thoroughfares and places of resort, those from the United States predominating among foreigners, although of course the delegates from the States of the Republic of Mexico constituted by far the larger number of representatives accredited to the congress.